APPENDIX 4

ENHANCED VAPOR RECOVERY TECHNOLOGY REVIEW

UPDATED EVR COST ANALYSIS SPREADSHEET

COST-EFFECTIVENESS SUMMARY

Input Values Used in Cost Analysis

Input variable used in Cost Analysis	Input value for each Model GDF 1	2	3	4	5
Nominal Monthly Average Sales per GDF, gals/month-GD	13,233	37,500	75,000	150,000	300,000
Population Distribution (EPA, 1991 adjusted to fit current p	4.7%	14.1%	45.7%	31.3%	4.2%
Estimated Number of GDFs (11,250 total)	531	1,586	5,136	3,522	475
Total Annual Sales, million gals/yr	84	714	4,626	6,344	1,712
Number of Processors per GDF (when applicable)	1	1	1	1	1
Number of Drop Tubes & Spill Buckets per GDF	2.5	2.5	2.5	2.5	2.5
Wtd-Avg Number of Nozzles per GDF (EPA, 1991)	2.5	3.25	6.5	9.75	16.25
Number of Dispensers per GDF (EPA, 1991)	2	3	6	9	12

Est. population-wtd average gallons per month using popu	99,779	Total 1997 CA gasoline sales =	13,481,725,000	gals
Actual population-wtd average gallons per month	99,865	Total GDFs in CA in 1998 =	11,250	

Emission Reductions per Model GDF

Module	Description	2010 ROG Reductions Statewide, tons/day	Emission Reductions by Model GDF and Module, tons/day 1	2	3	4	5
1	Phase I	5.0	0.03	0.26	1.72	2.35	0.64
2	Phase II	3.1	0.02	0.16	1.06	1.46	0.39
3	ORVR Compatibility	6.3	0.04	0.33	2.16	2.96	0.80
4	Liquid Retention	0.2	0.00	0.01	0.07	0.09	0.03
5	Spillage/Dripless Nozzl	3.9	0.02	0.21	1.34	1.84	0.50
6	In-Station Diagnostics	6.6	0.04	0.35	2.26	3.11	0.84
	Total	25.1	0.16	1.33	8.61	11.81	3.19

Cost-Effectiveness (C.E.) & Impacts to GDFs and Consumers

Module	Description	Cost-Effectiveness by Model GDF and Module, 1999 Dollars per Pound ROG Reduced 1	2	3	4	5	Overall Cost-Effectiveness by Module only
1	Phase I C.E. (Annual Costs/Annual Reductions)	$5.31	$1.72	$0.74	$0.25	$0.01	$0.50
	Annualized Equip Costs (assumes 25%/yr conv	$76,962.74	$229,909.89	$744,386.28	$510,432.58	$68,875.13	
	Annualized R&D Costs (assume 5% of Total R&	$29,649.52	$88,571.65	$286,771.14	$196,641.63	$26,533.81	
	Annualized Cert & Testing (assume 5% of Tota	$20,103.77	$60,055.77	$194,444.38	$133,332.32	$17,991.17	
	Annual Gasoline Recovery Credit	($5,435.46)	($46,052.87)	($298,213.56)	($408,975.61)	($110,370.11)	
2	Phase II C.E. (Annual Costs/Annual Reductions)	$57.41	$20.73	$11.65	$6.41	$3.44	$8.91
	Annualized Equip Costs (assumes 25%/yr conv	$318,373.12	$1,028,725.48	$4,420,223.60	$3,778,060.20	$611,144.09	
	Annualized R&D Costs (assume 50% of Total F	$296,495.18	$885,716.53	$2,867,711.42	$1,966,416.33	$265,338.06	
	Annualized Cert & Testing (assume 50% of Tot	$201,037.74	$600,557.65	$1,944,443.82	$1,333,323.17	$179,911.74	
	Annual Gasoline Recovery Credit	($3,369.98)	($28,552.78)	($184,892.41)	($253,564.88)	($68,429.47)	
3	ORVR Compatibility (Annual Costs/Annual Reduc	$4.03	$1.38	$0.77	$0.37	$0.14	$0.55
	Annualized Equip Costs (assumes 25%/yr conv	$23,213.82	$97,188.07	$629,337.57	$647,313.92	$129,762.72	
	Annualized R&D Costs (assume 10% of Total F	$59,299.04	$177,143.31	$573,542.28	$393,283.27	$53,067.61	
	Annualized Cert & Testing (assume 10% of Tot	$40,207.55	$120,111.53	$388,888.76	$266,664.63	$35,982.35	
	Annual Gasoline Recovery Credit	($6,848.68)	($58,026.62)	($375,749.09)	($515,309.27)	($139,066.34)	
4	Liquid Retention (Annual Costs/Annual Reduction	$62.15	$22.59	$12.99	$7.28	$4.43	$10.03
	Annualized Equip Costs (assumes 25%/yr conv	$7,213.57	$28,013.73	$181,401.80	$186,583.34	$41,960.99	
	Annualized R&D Costs (assume 5% of Total R&	$29,649.52	$88,571.65	$286,771.14	$196,641.63	$26,533.81	
	Annualized Cert & Testing (assume 5% of Tota	$20,103.77	$60,055.77	$194,444.38	$133,332.32	$17,991.17	
	Annual Gasoline Recovery Credit	($217.42)	($1,842.11)	($11,928.54)	($16,359.02)	($4,414.80)	
5	Spillage/Dripless Nozzle (Annual Costs/Annual R	$2.96	$0.93	$0.44	$0.15	$0.00	$0.29
	Annualized Equip Costs (assumes 25%/yr conv	$7,213.57	$28,013.73	$181,401.80	$186,583.34	$41,960.99	
	Annualized R&D Costs (assume 5% of Total R&	$29,649.52	$88,571.65	$286,771.14	$196,641.63	$26,533.81	
	Annualized Cert & Testing (assume 5% of Tota	$20,103.77	$60,055.77	$194,444.38	$133,332.32	$17,991.17	
	Annual Gasoline Recovery Credit	($4,239.66)	($35,921.24)	($232,606.58)	($319,000.98)	($86,088.69)	
6	In-Station Diagnostics (Annual Costs/Annual Red	$19.55	$7.18	$4.12	$2.27	$1.18	$3.14
	Annualized Equip Costs (assumes 25%/yr conv	$347,474.77	$1,149,659.24	$4,806,783.92	$4,039,706.08	$645,441.32	
	Annualized R&D Costs (assume 25% of Total F	$148,247.59	$442,858.26	$1,433,855.71	$983,208.16	$132,669.03	
	Annualized Cert & Testing (assume 25% of Tot	$100,518.87	$300,278.83	$972,221.91	$666,661.59	$89,955.87	
	Annual Gasoline Recovery Credit	($7,174.81)	($60,789.79)	($393,641.90)	($539,847.81)	($145,688.55)	
	Total Annual Costs by Model GDF Category	$1,748,231.43	$5,302,873.09	$19,090,813.36	$13,895,100.87	$1,875,586.87	**$41,912,606**
	Total Annual Costs per each GDF in a Model GD	**$3,292.34**	**$3,343.02**	**$3,717.17**	**$3,945.57**	**$3,946.94**	*overall annual cost*
	Per-gallon cost increase for consumers, cents/ga	**2.07**	**0.74**	**0.41**	**0.22**	**0.11**	**0.31**
	Non-Wtd Cost-Effectiveness for All Modules by M	$15.25	$5.46	$3.04	$1.61	$0.81	*vg. per-gal increas*

(cents per gallon)

Notes:

Gasoline price/gal assu $1.50

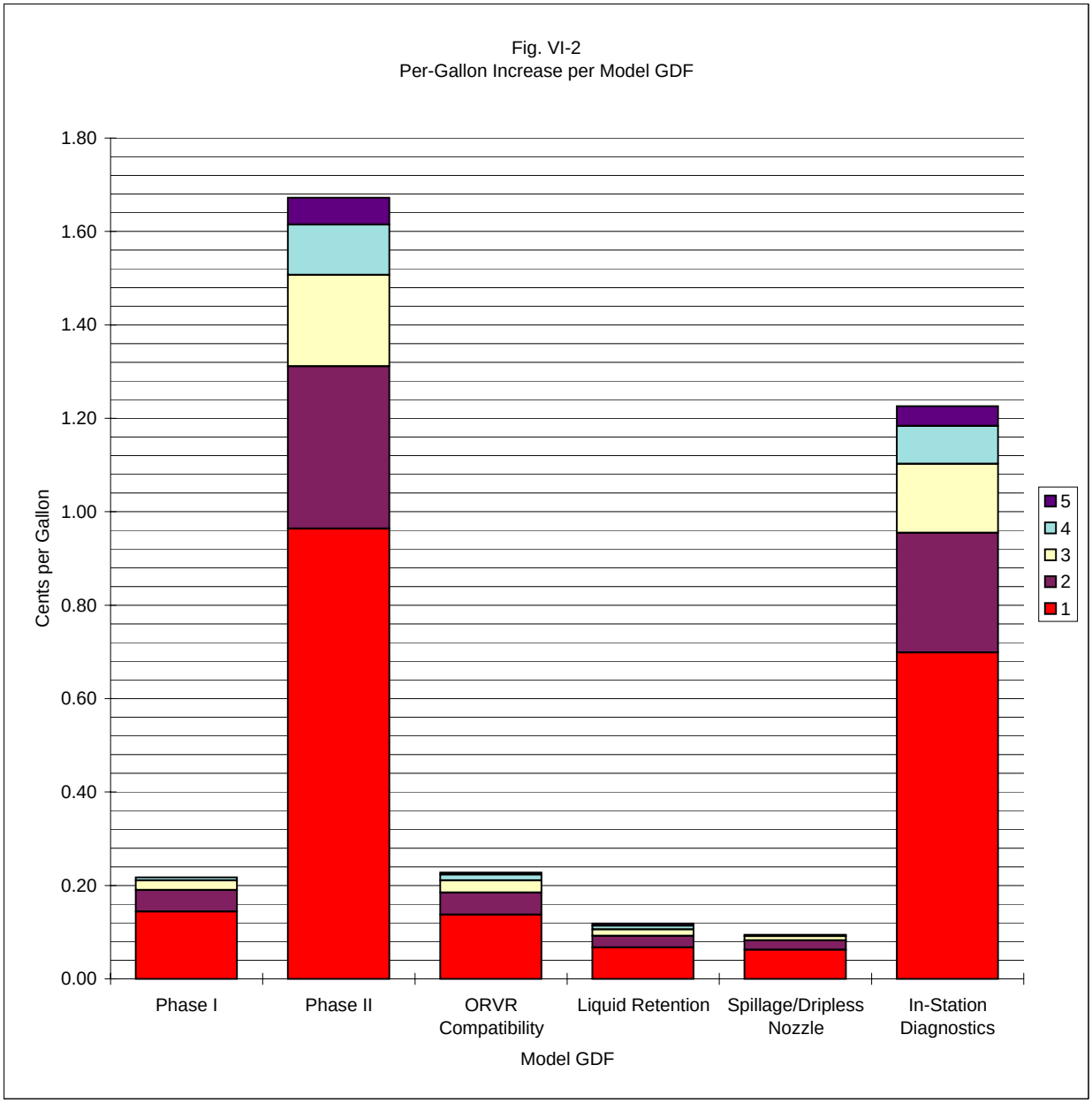
Per-gallon increase for consumers assumes all costs passed on to consumers

Gasoline density, lb/gal 6.3

Per-Gallon Cost Increase by Module and Model GDF

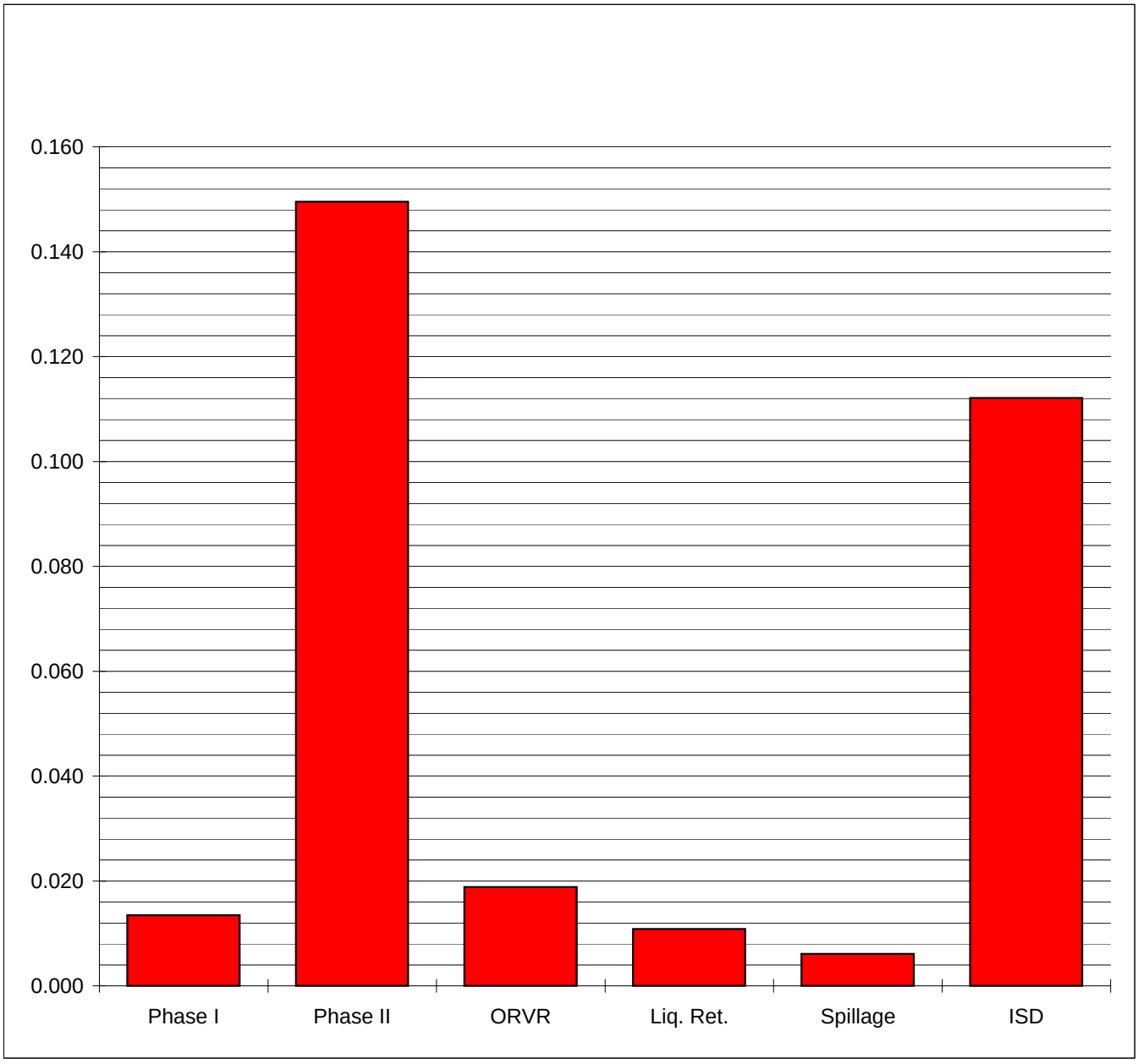
		Per-Gallon Cost Increase by Module and Model GDF, cents per gallon				
	Model GDF	1	2	3	4	5
Module	Per-GDF Throughput, g	13,233	37,500	75,000	150,000	300,000
1	Phase I	0.14	0.05	0.02	0.01	0.00
2	Phase II	0.96	0.35	0.20	0.11	0.06
3	ORVR Compatibility	0.14	0.05	0.03	0.01	0.00
4	Liquid Retention	0.07	0.02	0.01	0.01	0.00
5	Spillage/Dripless Nozzl	0.06	0.02	0.01	0.00	0.00
6	In-Station Diagnostics	0.70	0.26	0.15	0.08	0.04
Total Cents per Gal Increase by		2.07	0.74	0.41	0.22	0.11

Fig. VI-2
Per-Gallon Increase per Model GDF



Per-Gallon Cost Increase by Module

Module	Description	Annual Costs, $Million/yr	Cents per Gallon
1	Phase I	$1.8	0.013
2	Phase II	$20.2	0.150
3	ORVR	$2.5	0.019
4	Liq. Ret.	$1.5	0.011
5	Spillage	$0.8	0.006
6	ISD	$15.1	0.112
	Total	$41.9	0.311



Estimated Equipment Costs for a Model GDF 1 Facility per Proposed Module

Proposed Module	Unit Cost 1999 Dollars	Number of Components in Model GDF Bal-1	Bal-2	Hybrid	Assist-1	Assist-2
Module 1 (Phase I)						
Phase I Components						
Pressure/Vacuum (P/V) valve	$65	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cov	$351	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$178	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$55	2.5	2.5	2.5	2.5	2.5
Installation Costs						
Pressure/Vacuum (P/V) Valve	$80	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cov	$160	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$160	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$80	2.5	2.5	2.5	2.5	2.5
Module 1 -- Total Fixed Cost (All Equipment)		$2,823	$2,823	$2,823	$2,823	$2,823
Module 1 -- Total Annualized Cost = Total Fixed Cost x CRF		$580	$580	$580	$580	$580
		Avg Fixed	$2,823	Avg Annual		$580
Module 2 (Phase II w/pressure-related fugitives)						
Dispenser Components						
Nozzle -- Balance	$200	2.5	2.5			
Nozzle -- Hybrid	$231			2.5		
Nozzle -- Assist Type 1	$209				2.5	
Nozzle -- Assist Type 2	$225					2.5
Modified Equipment (Dispenser-related)	$382	2.5	2.5			
Modified Equipment (Dispenser-related)	$468			2.5		
Modified Equipment (Dispenser-related)	$400				2.5	

Modified Equipment (Dispenser-related)	$220						2.5
Auxilliary Items (incl. P/V, collection & processor)							
Assist Type 1	$7,500					1.0	
Assist Type 2	$9,000						1.0
Vapor processor							
for those Balance systems that use proc	$7,500		1.0	1.0	1.0		
Installation Costs		old					
Nozzle -- Balance	$172	$86	2.5	2.5			
Nozzle -- Hybrid	$215	$108			2.5		
Nozzle -- Assist Type 1	$97	$48				2.5	
Nozzle -- Assist Type 2	$108	$54					2.5
Modified Equipment (Dispenser-related)	$344	$172	2.5	2.5			
Modified Equipment (Dispenser-related)	$430	$215			2.5		
Modified Equipment (Dispenser-related)	$194	$97				2.5	
Modified Equipment (Dispenser-related)	$215	$108					2.5
Auxilliary Items -- Assist Type 1	$3,012	$1,506				1.0	
Auxilliary Items -- Assist Type 2	$2,581	$1,291					1.0
Vapor processor -- Balance	$3,012	$1,506	1.0	1.0	1.0		
Module 2 -- Total Fixed Cost (All Equipment)			$13,257	$13,257	$13,873	$12,760	$13,501
Module 2 -- Total Fixed Cost (TFC Nozzles)			$715	$715	$847	$643	$696
Module 2 -- Total Fixed Cost (TFC Dispensers)			$1,385	$1,385	$1,707	$1,242	$820
Module 2 -- Total Fixed Cost (TFC All Other Equipment)			$11,157	$11,157	$11,319	$10,875	$11,985
Module 2 -- Annualized Cost = Fixed Costs (TFC Nozzles) x			$288	$288	$341	$259	$280
Module 2 -- Annualized Cost = Fixed Costs (TFC Dispensers			$284	$284	$351	$255	$168
Module 2 -- Annualized Cost = Fixed Cost (TFC All Others) x			$1,816	$1,816	$1,842	$1,770	$1,950
Module 2 -- Total Annualized Costs (All Equipment)			$2,388	$2,388	$2,533	$2,284	$2,399
			Avg Fixed	$13,330	Avg Annual		$2,398

Module 3 (ORVR Compatibility)

Components						
Nozzle (Healy ORVR compatible drop-in	$54				2.5	2.5
Assumed 25% premium over Module 2-compliant nozzle (applies to assist only)						
Dispenser sensor & related electronics (Hoffer Flow Control)	$200	2.0	2.0	2.0		
Installation Costs						
Nozzle (Healy ORVR compatible drop-in	$160				2.5	2.5
Dispenser sensor & related electronics	$160	2.0	2.0	2.0		
Module 3 -- Total Fixed Costs (Equipment Purchase + Instal		$720	$720	$720	$536	$536
Module 3 -- Total Fixed Costs (Nozzles)		$0	$0	$0	$536	$536
Module 3 -- Total Fixed Costs (Dispensers)		$720	$720	$720	$0	$0
Module 3 -- Annualized Costs = Fixed Costs (Nozzles) x CRI		$0	$0	$0	$215	$215
Module 3 -- Annualized Costs = Fixed Costs (Dispensers) x (		$148	$148	$148	$0	$0
Module 3 -- Total Annualized Costs (All Equipment)		$148	$148	$148	$215	$215
		Avg Fixed	$646	Avg Annual		$175

Module 4 (Liquid Retention -- Redesigned Nozzle)

Assumed 25% premium over Module 2-nozzle; in-nozzle design only; no extra installation	$54	2.5	2.5	2.5	2.5	2.5
Module 4 -- Total Fixed Costs (Equipment Purchase + Instal		$135	$135	$135	$135	$135
Module 4 -- Annualized Costs = Fixed Costs x CRF3		$54	$54	$54	$54	$54
		Avg Fixed	$135	Avg Annual		$54

Module 5 (Spillage, including Dripless Nozzle)

Assumed 25% premium over Module 2-nozzle; in-nozzle design only; no extra installation	$54	2.5	2.5	2.5	2.5	2.5
Module 5 -- Total Fixed Costs (All Equipment)		$135	$135	$135	$135	$135
Module 5 -- Annualized Costs = Fixed Costs x CRF3		$54	$54	$54	$54	$54
		Avg Fixed	$135	Avg Annual		$54

Module 6 (In-Station Diagnostics)

Components (Veeder-Root Cost Estimates)		(OLD)					
Sensors -- Pressure	$750	$192	1.0	1.0	1.0	1.0	1.0
Sensors -- A/L	$900	$245	1.0	1.0	1.0	1.0	1.0
Datalogger w/EPROM & new CPU/moth	$4,500	$1,197	1.0	1.0	1.0	1.0	1.0
Installation Costs (double original values)							
Assumed 2 person-days/dispenser for I	$2,560	$1,280	1.0	1.0	1.0	1.0	1.0
Module 6 -- Total Fixed Costs (All Equipment)			$8,710	$8,710	$8,710	$8,710	$8,710
Module 6 -- Annualized Costs = Total Fixed Costs x CRF1			$1,418	$1,418	$1,418	$1,418	$1,418
Module 6 - Annualized maintenance/calib/repair			$1,200	$1,200	$1,200	$1,200	$1,200
			Avg Fixed	$8,710	Avg Annual		$2,618

Total Fixed Costs (All Modules)	$25,780	$25,780	$26,396	$25,098	$25,839
Total Annualized Fixed Costs (All Modules)	$4,642	$4,642	$4,787	$4,605	$4,720

Notes

Cost Recovery Factor CRF1 (10% discou	0.1627
Cost Recovery Factor CRF2 (10% discou	0.2054
Cost Recovery Factor CRF3 (10% discou	0.4021

* from Healy Systems, 1999.

Average Total Fixed Cost	$25,779
Average Total Annualized Cost	$4,679

Estimated Equipment Costs for a Model GDF 2 Facility per Proposed Module

Proposed Module	Unit Cost 1999 Dollars	Number of Components in Model GDF Bal-1	Bal-2	Hybrid	Assist-1	Assist-2
Module 1 (Phase I)						
Phase I Components						
Pressure/Vacuum (P/V) valve	$65	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cover	$351	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$178	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$55	2.5	2.5	2.5	2.5	2.5
Installation Costs						
Pressure/Vacuum (P/V) Valve	$80	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cover	$160	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$160	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$80	2.5	2.5	2.5	2.5	2.5
Module 1 -- Total Fixed Cost (All Equipment)		$2,823	$2,823	$2,823	$2,823	$2,823
Module 1 -- Total Annualized Cost = Total Fixed Cost x CRF2		$580	$580	$580	$580	$580
		Avg Fixed	$2,823	Avg Annual		$580
Module 2 (Phase II w/pressure-related fugitives)						
Dispenser Components						
Nozzle -- Balance	$200	3.25	3.25			
Nozzle -- Hybrid	$231			3.25		
Nozzle -- Assist Type 1	$209				3.25	
Nozzle -- Assist Type 2	$225					3.25
Modified Equipment (Dispenser-related) -- Balance	$382	3.25	3.25			
Modified Equipment (Dispenser-related) -- Hybrid	$468			3.25		
Modified Equipment (Dispenser-related) -- Assist Typ	$400				3.25	
Modified Equipment (Dispenser-related) -- Assist Typ	$220					3.25
Auxilliary Items (incl. P/V, collection & processor)						
Assist Type 1	$7,500				1.00	
Assist Type 2	$9,000					1.00

Vapor processor							
for those Balance systems that use processors	$7,500		1.00	1.00	1.00		
Installation Costs		OLD					
Nozzle -- Balance	$172	$86	3.25	3.25			
Nozzle -- Hybrid	$215	$108			3.25		
Nozzle -- Assist Type 1	$97	$48				3.25	
Nozzle -- Assist Type 2	$108	$54					3.25
Modified Equipment (Dispenser-related) -- Balance	$344	$172	3.25	3.25			
Modified Equipment (Dispenser-related) -- Hybrid	$430	$215			3.25		
Modified Equipment (Dispenser-related) -- Assist Typ	$194	$97				3.25	
Modified Equipment (Dispenser-related) -- Assist Typ	$215	$108					3.25
Auxilliary Items -- Assist Type 1	$3,012	$1,506				1.00	
Auxilliary Items -- Assist Type 2	$2,581	$1,291					1.00
Vapor processor -- Balance	$3,012	$1,506	1.00	1.00	1.00		
Module 2 -- Total Fixed Cost (All Equipment)			$14,081	$14,081	$14,882	$13,434	$14,077
Module 2 -- Total Fixed Cost (TFC Nozzles)			$930	$930	$1,101	$836	$905
Module 2 -- Total Fixed Cost (TFC Dispensers)			$1,800	$1,800	$2,220	$1,615	$1,066
Module 2 -- Total Fixed Cost (TFC All Other Equipment)			$11,351	$11,351	$11,561	$10,983	$12,106
Module 2 -- Annualized Cost = Fixed Costs (TFC Nozzles) x CRF3			$374	$374	$443	$336	$364
Module 2 -- Annualized Cost = Fixed Costs (TFC Dispensers) x CRF2			$370	$370	$456	$332	$219
Module 2 -- Annualized Cost = Fixed Cost (TFC All Others) x CRF1			$1,847	$1,847	$1,881	$1,788	$1,970
Module 2 -- Total Annualized Costs (All Equipment)			$2,591	$2,591	$2,780	$2,455	$2,553
			Avg Fixed	$14,111	Avg Annual		$2,594

Module 3 (ORVR Compatibility)

Components						
Nozzle (Healy ORVR compatible drop-in assist nozz	$54				3.25	3.25
Assumed 25% premium over Module 2-compliant nozzle (applies to assist only)						
Dispenser sensor & related electronics (Hoffer Flow Control)	$200	3.00	3.00	3.00		
Installation Costs						
Nozzle (Healy ORVR compatible drop-in assist nozz	$160				3.25	3.25
Dispenser sensor & related electronics	$160	3.00	3.00	3.00		
Module 3 -- Total Fixed Costs (Equipment Purchase + Installation)		$1,080	$1,080	$1,080	$696	$696
Module 3 -- Total Fixed Costs (Nozzles)		$0	$0	$0	$696	$696
Module 3 -- Total Fixed Costs (Dispensers)		$1,080	$1,080	$1,080	$0	$0
Module 3 -- Annualized Costs = Fixed Costs (Nozzles) x CRF3		$0	$0	$0	$280	$280
Module 3 -- Annualized Costs = Fixed Costs (Dispensers) x CRF2		$222	$222	$222	$0	$0
Module 3 -- Total Annualized Costs (All Equipment)		$222	$222	$222	$280	$280
		Avg Fixed	$926	Avg Annual		$245

Module 4 (Liquid Retention -- Redesigned Nozzle)

Assumed 25% premium over Module 2-compliant nozzle; in-nozzle design only; no extra installation	$54	3.25	3.25	3.25	3.25	3.25
Module 4 -- Total Fixed Costs (Equipment Purchase + Installation)		$176	$176	$176	$176	$176
Module 4 -- Annualized Costs = Fixed Costs x CRF3		$71	$71	$71	$71	$71
		Avg Fixed	$176	Avg Annual		$71

Module 5 (Spillage, including Dripless Nozzle)

Assumed 25% premium over Module 2-compliant nozzle; in-nozzle design only; no extra installation	$54	3.25	3.25	3.25	3.25	3.25
Module 5 -- Total Fixed Costs (All Equipment)		$176	$176	$176	$176	$176
Module 5 -- Annualized Costs = Fixed Costs x CRF3		$71	$71	$71	$71	$71
		Avg Fixed	$176	Avg Annual		$71

Module 6 (In-Station Diagnostics)

Components		(OLD)					
Sensors -- Pressure	$750	$192	1.0	1.0	1.0	1.0	1.0
Sensors -- A/L	$900	$245	1.5	1.5	1.5	1.5	1.5
Datalogger w/EPROM & new CPU/motherboard	$4,500	$1,197	1.0	1.0	1.0	1.0	1.0
Installation Costs							
Assumed 2 person-days/dispenser for ISD installatio	$2,560	$1,280	1.5	1.5	1.5	1.5	1.5
Module 6 -- Total Fixed Costs (All Equipment)			$10,440	$10,440	$10,440	$10,440	$10,440
Module 6 -- Annualized Costs = Total Fixed Costs x CRF1			$1,699	$1,699	$1,699	$1,699	$1,699
Module 6 - Annualized maintenance/calib/repair			$1,200	$1,200	$1,200	$1,200	$1,200
			Avg Fixed	$10,440	Avg Annual		$2,899

Total Fixed Costs (All Modules)	$28,775	$28,775	$29,575	$27,744	$28,387
Total Annualized Fixed Costs (All Modules)	$5,233	$5,233	$5,422	$5,155	$5,253

Notes

Cost Recovery Factor CRF1 (10% discount, 10 yr. life)	0.1627
Cost Recovery Factor CRF2 (10% discount, 7 yr. life)	0.2054
Cost Recovery Factor CRF3 (10% discount, 3 yr. life)	0.4021

* from Healy Systems, 1999.

Average Total Fixed Cost	$28,651
Average Total Annualized Cost	$5,259

Estimated Equipment Costs for a Model GDF 3 Facility per Proposed Module

Proposed Module	Unit Cost 1999 Dollars	Number of Components in Model GDF Bal-1	Bal-2	Hybrid	Assist-1	Assist-2
Module 1 (Phase I)						
Phase I Components						
Pressure/Vacuum (P/V) valve	$65	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cover	$351	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$178	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$55	2.5	2.5	2.5	2.5	2.5
Installation Costs						
Pressure/Vacuum (P/V) Valve	$80	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cover	$160	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$160	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$80	2.5	2.5	2.5	2.5	2.5
Module 1 -- Total Fixed Cost (All Equipment)		$2,823	$2,823	$2,823	$2,823	$2,823
Module 1 -- Total Annualized Cost = Total Fixed Cost x CRF2		$580	$580	$580	$580	$580
		Avg Fixed	$2,823	Avg Annual		$580
Module 2 (Phase II w/pressure-related fugitives)						
Dispenser Components						
Nozzle -- Balance	$200	6.5	6.5			
Nozzle -- Hybrid	$231			6.5		
Nozzle -- Assist Type 1	$209				6.5	
Nozzle -- Assist Type 2	$225					6.5
Modified Equipment (Dispenser-related) -- Balance	$382	6.5	6.5			
Modified Equipment (Dispenser-related) -- Hybrid	$468			6.5		
Modified Equipment (Dispenser-related) -- Assist Type 1	$400				6.5	
Modified Equipment (Dispenser-related) -- Assist Type 2	$220					6.5
Auxilliary Items (incl. P/V, collection & processor)						
Assist Type 1	$7,500				1.0	
Assist Type 2	$9,000					1.0
Vapor processor						
for those Balance systems that use processors	$7,500	1.0	1.0	1.0		

Installation Costs							
Nozzle -- Balance	$86	$172	6.5	6.5			
Nozzle -- Hybrid	$108	$215			6.5		
Nozzle -- Assist Type 1	$48	$97				6.5	
Nozzle -- Assist Type 2	$54	$108					6.5
Modified Equipment (Dispenser-related) -- Balan	$172	$344	6.5	6.5			
Modified Equipment (Dispenser-related) -- Hybri	$215	$430			6.5		
Modified Equipment (Dispenser-related) -- Assist	$97	$194				6.5	
Modified Equipment (Dispenser-related) -- Assist	$108	$215					6.5
Auxilliary Items -- Assist Type 1	$1,506	$3,012				1.0	
Auxilliary Items -- Assist Type 2	$1,291	$2,581					1.0
Vapor processor -- Balance	$1,506	$3,012	1.0	1.0	1.0		
Module 2 -- Total Fixed Cost (All Equipment)			$17,649	$17,649	$19,251	$16,357	$16,573
Module 2 -- Total Fixed Cost (TFC Nozzles)			$1,859	$1,859	$2,202	$1,672	$1,811
Module 2 -- Total Fixed Cost (TFC Dispensers)			$3,600	$3,600	$4,439	$3,230	$2,132
Module 2 -- Total Fixed Cost (TFC All Other Equipment)			$12,190	$12,190	$12,609	$11,455	$12,630
Module 2 -- Annualized Cost = Fixed Costs (TFC Nozzles) x CRF3			$748	$748	$886	$672	$728
Module 2 -- Annualized Cost = Fixed Costs (TFC Dispensers) x CRF2			$740	$740	$912	$663	$438
Module 2 -- Annualized Cost = Fixed Cost (TFC All Others) x CRF1			$1,984	$1,984	$2,052	$1,864	$2,055
Module 2 -- Total Annualized Costs (All Equipment)			$3,471	$3,471	$3,850	$3,200	$3,222
			Avg Fixed	$17,496	Avg Annual		$3,443

Module 3 (ORVR Compatibility)

Components						
Nozzle (Healy ORVR compatible drop-in assist nozzle)	$54				6.5	6.5
Assumed 25% premium over Module 2-compliant nozzle (applies to assist only)						
Dispenser sensor & related electronics (Hoffer Flow Control)	$200	6.0	6.0	6.0		
Installation Costs						
Nozzle (Healy ORVR compatible drop-in assist nozzle)*	$160				6.5	6.5
Dispenser sensor & related electronics	$160	6.0	6.0	6.0		
Module 3 -- Total Fixed Costs (Equipment Purchase + Installation)		$2,160	$2,160	$2,160	$1,392	$1,392
Module 3 -- Total Fixed Costs (Nozzles)		$0	$0	$0	$1,392	$1,392
Module 3 -- Total Fixed Costs (Dispensers)		$2,160	$2,160	$2,160	$0	$0
Module 3 -- Annualized Costs = Fixed Costs (Nozzles) x CRF3		$0	$0	$0	$560	$560
Module 3 -- Annualized Costs = Fixed Costs (Dispensers) x CRF2		$444	$444	$444	$0	$0
Module 3 -- Total Annualized Costs (All Equipment)		$444	$444	$444	$560	$560
		Avg Fixed	$1,853	Avg Annual		$490

Module 4 (Liquid Retention -- Redesigned Nozzle)

Assumed 25% premium over Module 2-compliant nozzle; in-nozzle design only; no extra installation	$54	6.5	6.5	6.5	6.5	6.5
Module 4 -- Total Fixed Costs (Equipment Purchase + Installation)		$351	$351	$351	$351	$351
Module 4 -- Annualized Costs = Fixed Costs x CRF3		$141	$141	$141	$141	$141
		Avg Fixed	$351	Avg Annual		$141

Module 5 (Spillage, including Dripless Nozzle)

Assumed 25% premium over Module 2-compliant nozzle; in-nozzle design only; no extra installation	$54	6.5	6.5	6.5	6.5	6.5
Module 5 -- Total Fixed Costs (All Equipment)		$351	$351	$351	$351	$351
Module 5 -- Annualized Costs = Fixed Costs x CRF3		$141	$141	$141	$141	$141
		Avg Fixed	$351	Avg Annual		$141

Module 6 (In-Station Diagnostics)

Components	(OLD)						
Sensors -- Pressure	$192	$750	1.0	1.0	1.0	1.0	1.0
Sensors -- A/L	$245	$900	3.0	3.0	3.0	3.0	3.0
Datalogger w/EPROM & new CPU/motherboard	$1,197	$4,500	1.0	1.0	1.0	1.0	1.0
Installation Costs							
Assumed 2 person-days/dispenser for ISD instal	$1,280	$2,560	3.0	3.0	3.0	3.0	3.0
Module 6 -- Total Fixed Costs (All Equipment)			$15,630	$15,630	$15,630	$15,630	$15,630
Module 6 -- Annualized Costs = Total Fixed Costs x CRF1			$2,544	$2,544	$2,544	$2,544	$2,544
Module 6 - Annualized maintenance/calib/repair			$1,200	$1,200	$1,200	$1,200	$1,200
			Avg Fixed	$15,630	Avg Annual		$3,744

Total Fixed Costs (All Modules)	$38,965	$38,965	$40,566	$36,905	$37,121
Total Annualized Fixed Costs (All Modules)	$7,321	$7,321	$7,699	$7,166	$7,187

Notes

Cost Recovery Factor CRF1 (10% discount, 10 yr. life) -- All	0.1627
Cost Recovery Factor CRF2 (10% discount, 7 yr. life) -- Disp	0.2054
Cost Recovery Factor CRF3 (10% discount, 3 yr. life) -- Noz	0.4021

* from Healy Systems, 1999.

Average Total Fixed Cost	$38,504
Average Total Annualized Cost	$7,339

Estimated Equipment Costs for a Model GDF 4 Facility per Proposed Module

Proposed Module	Unit Cost 1999 Dollars	Number of Components in Model GDF Bal-1	Bal-2	Hybrid	Assist-1	Assist-2
Module 1 (Phase I)						
Phase I Components						
Pressure/Vacuum (P/V) valve	$65	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cover	$351	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$178	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$55	2.5	2.5	2.5	2.5	2.5
Installation Costs						
Pressure/Vacuum (P/V) Valve	$80	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cover	$160	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$160	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$80	2.5	2.5	2.5	2.5	2.5
Module 1 -- Total Fixed Cost (All Equipment)		$2,823	$2,823	$2,823	$2,823	$2,823
Module 1 -- Total Annualized Cost = Total Fixed Cost x CRF2		$580	$580	$580	$580	$580
		Avg Fixed	$2,823	Avg Annual		$580
Module 2 (Phase II w/pressure-related fugitives)						
Dispenser Components						
Nozzle -- Balance	$200	9.8	9.75			
Nozzle -- Hybrid	$231			9.75		
Nozzle -- Assist Type 1	$209				9.75	
Nozzle -- Assist Type 2	$225					9.75
Modified Equipment (Dispenser-related) -- Balance	$382	9.75	9.75			
Modified Equipment (Dispenser-related) -- Hybrid	$468			9.75		
Modified Equipment (Dispenser-related) -- Assist Type	$400				9.75	
Modified Equipment (Dispenser-related) -- Assist Type	$220					9.75
Auxilliary Items (incl. P/V, collection & processor)						
Assist Type 1	$7,500				1.00	
Assist Type 2	$9,000					1.00
Vapor processor						
for those Balance systems that use processors	$7,500	1.00	1.00	1.00		

Installation Costs		(OLD)					
Nozzle -- Balance	$172	$86	9.75	9.75			
Nozzle -- Hybrid	$215	$108			9.75		
Nozzle -- Assist Type 1	$97	$48				9.75	
Nozzle -- Assist Type 2	$108	$54					9.75
Modified Equipment (Dispenser-related) -- Balance	$344	$172	9.75	9.75			
Modified Equipment (Dispenser-related) -- Hybrid	$430	$215			9.75		
Modified Equipment (Dispenser-related) -- Assist Type	$194	$97				9.75	
Modified Equipment (Dispenser-related) -- Assist Type	$215	$108					9.75
Auxilliary Items -- Assist Type 1	$3,012	$1,506				1.00	
Auxilliary Items -- Assist Type 2	$2,581	$1,291					1.00
Vapor processor -- Balance	$3,012	$1,506	1.00	1.00	1.00		

Module 2 -- Total Fixed Cost (All Equipment)	$21,218	$21,218	$23,621	$19,280	$19,069
Module 2 -- Total Fixed Cost (TFC Nozzles)	$2,789	$2,789	$3,303	$2,508	$2,716
Module 2 -- Total Fixed Cost (TFC Dispensers)	$5,401	$5,401	$6,659	$4,845	$3,198
Module 2 -- Total Fixed Cost (TFC All Other Equipment)	$13,029	$13,029	$13,658	$11,927	$13,154
Module 2 -- Annualized Cost = Fixed Costs (TFC Nozzles) x CRF3	$1,121	$1,121	$1,328	$1,009	$1,092
Module 2 -- Annualized Cost = Fixed Costs (TFC Dispensers) x CRF2	$1,109	$1,109	$1,368	$995	$657
Module 2 -- Annualized Cost = Fixed Cost (TFC All Others) x CRF1	$2,120	$2,120	$2,223	$1,941	$2,141
Module 2 -- Total Annualized Costs (All Equipment)	$4,351	$4,351	$4,919	$3,945	$3,890
	Avg Fixed	$20,881	Avg Annual		$4,291

Module 3 (ORVR Compatibility)

Components						
Nozzle (Healy ORVR compatible drop-in assist nozzle)	$54				9.8	9.8
Assumed 25% premium over Module 2-compliant nozzle (applies to assist only)						
Dispenser sensor & related electronics (Hoffer Flow Control)	$200	9.0	9.0	9.0		
Installation Costs						
Nozzle (Healy ORVR compatible drop-in assist nozzle)	$160				9.8	9.8
Dispenser sensor & related electronics	$160	9.0	9.0	9.0		
Module 3 -- Total Fixed Costs (Equipment Purchase + Installation)		$3,240	$3,240	$3,240	$2,088	$2,088
Module 3 -- Total Fixed Costs (Nozzles)		$0	$0	$0	$2,088	$2,088
Module 3 -- Total Fixed Costs (Dispensers)		$3,240	$3,240	$3,240	$0	$0
Module 3 -- Annualized Costs = Fixed Costs (Nozzles) x CRF3		$0	$0	$0	$840	$840
Module 3 -- Annualized Costs = Fixed Costs (Dispensers) x CRF2		$666	$666	$666	$0	$0
Module 3 -- Total Annualized Costs (All Equipment)		$666	$666	$666	$840	$840
		Avg Fixed	$2,779	Avg Annual		$735

Module 4 (Liquid Retention -- Redesigned Nozzle)

Assumed 25% premium over Module 2-compliant nozzle; in-nozzle design only; no extra installation	$54	9.75	9.75	9.75	9.75	9.75
Module 4 -- Total Fixed Costs (Equipment Purchase + Installation)		$527	$527	$527	$527	$527
Module 4 -- Annualized Costs = Fixed Costs x CRF3		$212	$212	$212	$212	$212
		Avg Fixed	$527	Avg Annual		$212

Module 5 (Spillage, including Dripless Nozzle)

Assumed 25% premium over Module 2-compliant nozzle; in-nozzle design only; no extra installation	$54	9.75	9.75	9.75	9.75	9.75
Module 5 -- Total Fixed Costs (All Equipment)		$527	$527	$527	$527	$527
Module 5 -- Annualized Costs = Fixed Costs x CRF3		$212	$212	$212	$212	$212
		Avg Fixed	$527	Avg Annual		$212

Module 6 (In-Station Diagnostics)

Components		(OLD)					
Sensors -- Pressure	$750	$192	1.0	1.0	1.0	1.0	1.0
Sensors -- A/L	$900	$245	4.5	4.5	4.5	4.5	4.5
Datalogger w/EPROM & new CPU/motherboard	$4,500	$1,197	1.0	1.0	1.0	1.0	1.0
Installation Costs							
Assumed 2 person-days/dispenser for ISD installation	$2,560	$1,280	4.5	4.5	4.5	4.5	4.5
Module 6 -- Total Fixed Costs (All Equipment)			$20,820	$20,820	$20,820	$20,820	$20,820
Module 6 -- Annualized Costs = Total Fixed Costs x CRF1			$3,388	$3,388	$3,388	$3,388	$3,388
Module 6 - Annualized maintenance/calib/repair			$1,200	$1,200	$1,200	$1,200	$1,200
			Avg Fixed	$20,820	Avg Annual		$4,588

Total Fixed Costs (All Modules)	$49,155	$49,155	$51,557	$46,065	$45,854
Total Annualized Fixed Costs (All Modules)	$9,409	$9,409	$9,976	$9,177	$9,122

Notes

Cost Recovery Factor CRF1 (10% discount, 10 yr. life) -	0.1627
Cost Recovery Factor CRF2 (10% discount, 7 yr. life) --	0.2054
Cost Recovery Factor CRF3 (10% discount, 3 yr. life) --	0.4021

* from Healy Systems, 1999.

Average Total Fixed Cost	$48,357
Average Total Annualized Cost	$9,418

Estimated Equipment Costs for a Model GDF 5 Facility per Proposed Module

Proposed Module	Unit Cost 1999 Dollars	Number of Components in Model GDF Bal-1	Bal-2	Hybrid	Assist-1	Assist-2
Module 1 (Phase I)						
Phase I Components						
Pressure/Vacuum (P/V) valve	$65	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cover	$351	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$178	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$55	2.5	2.5	2.5	2.5	2.5
Installation Costs						
Pressure/Vacuum (P/V) Valve	$80	2.5	2.5	2.5	2.5	2.5
Low-emission spill containment and cover	$160	2.5	2.5	2.5	2.5	2.5
Drop tube & overfill protection	$160	2.5	2.5	2.5	2.5	2.5
Rotatable adaptor	$80	2.5	2.5	2.5	2.5	2.5
Module 1 -- Total Fixed Cost (All Equipment)		$2,823	$2,823	$2,823	$2,823	$2,823
Module 1 -- Total Annualized Cost = Total Fixed Cost x CRF2		$580	$580	$580	$580	$580
		Avg Fixed	$2,823	Avg Annual		$580
Module 2 (Phase II w/pressure-related fugitives)						
Dispenser Components						
Nozzle -- Balance	$200	16.3	16.25			
Nozzle -- Hybrid	$231			16.25		
Nozzle -- Assist Type 1	$209				16.25	
Nozzle -- Assist Type 2	$225					16.25
Modified Equipment (Dispenser-related) -- Balance	$382	16.25	16.25			
Modified Equipment (Dispenser-related) -- Hybrid	$468			16.25		
Modified Equipment (Dispenser-related) -- Assist Type	$400				16.25	
Modified Equipment (Dispenser-related) -- Assist Type	$220					16.25
Auxilliary Items (incl. P/V, collection & processor)						
Assist Type 1	$7,500				1.00	
Assist Type 2	$9,000					1.00
Vapor processor						

for those Balance systems that use processors	$7,500		1.00	1.00	1.00		
Installation Costs		(OLD)					
Nozzle -- Balance	$172	$86	16.25	16.25			
Nozzle -- Hybrid	$215	$108			16.25		
Nozzle -- Assist Type 1	$97	$48				16.25	
Nozzle -- Assist Type 2	$108	$54					16.25
Modified Equipment (Dispenser-related) -- Balance	$344	$172	16.25	16.25			
Modified Equipment (Dispenser-related) -- Hybrid	$430	$215			16.25		
Modified Equipment (Dispenser-related) -- Assist Type	$194	$97				16.25	
Modified Equipment (Dispenser-related) -- Assist Type	$215	$108					16.25
Auxilliary Items -- Assist Type 1	$3,012	$1,506				1.00	
Auxilliary Items -- Assist Type 2	$2,581	$1,291					1.00
Vapor processor -- Balance	$3,012	$1,506	1.00	1.00	1.00		

Module 2 -- Total Fixed Cost (All Equipment)	$22,655	$22,655	$25,610	$21,261	$20,148
Module 2 -- Total Fixed Cost (TFC Nozzles)	$4,648	$4,648	$5,506	$4,180	$4,527
Module 2 -- Total Fixed Cost (TFC Dispensers)	$9,001	$9,001	$11,099	$8,075	$5,331
Module 2 -- Total Fixed Cost (TFC All Other Equipment)	$9,006	$9,006	$9,006	$9,006	$10,291
Module 2 -- Annualized Cost = Fixed Costs (TFC Nozzles) x CRF3	$1,869	$1,869	$2,214	$1,681	$1,820
Module 2 -- Annualized Cost = Fixed Costs (TFC Dispensers) x CRF2	$1,849	$1,849	$2,280	$1,659	$1,095
Module 2 -- Annualized Cost = Fixed Cost (TFC All Others) x CRF1	$1,466	$1,466	$1,466	$1,466	$1,675
Module 2 -- Total Annualized Costs (All Equipment)	$5,184	$5,184	$5,959	$4,805	$4,590
	Avg Fixed	$22,466	Avg Annual		$5,144

Module 3 (ORVR Compatibility)

Components						
Nozzle (Healy ORVR compatible drop-in assist nozzle)	$54				16.25	16.25
Assumed 25% premium over Module 2-compliant nozzle (applies to assist only)						
Dispenser sensor & related electronics (Hoffer Flow Control)	$200	12.00	12.00	12.00		
Installation Costs						
Nozzle (Healy ORVR compatible drop-in assist nozzle)	$160				16.25	16.25
Dispenser sensor & related electronics	$160	12.00	12.00	12.00		
Module 3 -- Total Fixed Costs (Equipment Purchase + Installation)		$4,320	$4,320	$4,320	$3,481	$3,481
Module 3 -- Total Fixed Costs (Nozzles)		$0	$0	$0	$3,481	$3,481
Module 3 -- Total Fixed Costs (Dispensers)		$4,320	$4,320	$4,320	$0	$0
Module 3 -- Annualized Costs = Fixed Costs (Nozzles) x CRF3		$0	$0	$0	$1,400	$1,400
Module 3 -- Total Annualized Costs (All Equipment)		$887	$887	$887	$1,400	$1,400
		Avg Fixed	$3,984	Avg Annual		$1,092

Module 4 (Liquid Retention -- Redesigned Nozzle)

Assumed 25% premium over Module 2-compliant nozzle; in-nozzle design only; no extra installation	$54	16.25	16.25	16.25	16.25	16.25
Module 4 -- Total Fixed Costs (Equipment Purchase + Installation)		$878	$878	$878	$878	$878
Module 4 -- Annualized Costs = Fixed Costs x CRF3		$353	$353	$353	$353	$353
		Avg Fixed	$878	Avg Annual		$353

Module 5 (Spillage, including Dripless Nozzle)

Assumed 25% premium over Module 2-compliant nozzle; in-nozzle design only; no extra installation	$54	16.25	16.25	16.25	16.25	16.25
Module 5 -- Total Fixed Costs (All Equipment)		$878	$878	$878	$878	$878
Module 5 -- Annualized Costs = Fixed Costs x CRF3		$353	$353	$353	$353	$353
		Avg Fixed	$878	Avg Annual		$353

Module 6 (In-Station Diagnostics)

Components	(OLD)	

Sensors -- Pressure	$750	$192	1.00	1.00	1.00	1.00	1.00
Sensors -- A/L	$900	$245	6.00	6.00	6.00	6.00	6.00
Datalogger w/EPROM & new CPU/motherboard	$4,500	$1,197	1.00	1.00	1.00	1.00	1.00
Installation Costs							
Assumed 2 person-days/dispenser for ISD installation	$2,560	$1,280	6.0	6.00	6.00	6.00	6.00
Module 6 -- Total Fixed Costs (All Equipment)			$26,010	$26,010	$26,010	$26,010	$26,010
Module 6 -- Annualized Costs = Total Fixed Costs x CRF1			$4,233	$4,233	$4,233	$4,233	$4,233
Module 6 - Annualized maintenance/calib/repair			$1,200	$1,200	$1,200	$1,200	$1,200
			Avg Fixed	$26,010	Avg Annual		$5,433

Total Fixed Costs (All Modules)	$57,564	$57,564	$60,519	$55,331	$54,218
Total Annualized Fixed Costs (All Modules)	$11,590	$11,590	$12,366	$11,724	$11,509

Notes

Cost Recovery Factor CRF1 (10% discount, 10 yr. life) -	0.1627
Cost Recovery Factor CRF2 (10% discount, 7 yr. life) --	0.2054
Cost Recovery Factor CRF3 (10% discount, 3 yr. life) --	0.4021

* from Healy Systems, 1999.

Average Total Fixed Cost	$57,039
Average Total Annualized Cost	$11,756

Research & Development Costs for All Proposed Modules

Source
Staff Costs
Phase I systems
Engineering
Assumed number of full-time engineers needed per certification
Annual cost per engineer (salary + benefits)
Number of years required per certification
Non-engineering
Support staff needed per certfication (assume 1 support per 2 engineers)
Annual cost per support staff (salary + benefits; assume 50% of engineer cost)
Number of years required per certification
Total R&D Staff Costs per Phase I certification
Phase II & ISD systems
Engineering
Assumed number of full-time engineers needed per certification
Annual cost per engineer (salary + benefits)
Number of years required per certification
Non-engineering
Support staff needed per certfication (assume 1 support per 2 engineers)
Annual cost per support staff (salary + benefits; assume 50% of engineer cost)
Number of years required per certification
Total R&D Staff Costs per Phase II and ISD Certification
Component & Systems Development Costs (CSDC) per Certification
Design, prototype development, & commercialization cost per certification (assume 10% of total staff costs)
Miscellaneous Costs
Marketing costs per certification (assumed 25% of CSDC)
Total number of Phase II recertifications (as of 01/01/2000)
ISD systems to be developed & certified (assume 25% of total Ph II recertifications)
Total number of Phase I recertifications (as of 01/01/2000)

Total Research & Development Costs
Annualized R&D Costs (CRF @ 10% discount rate, 5 yrs)

Certification and Testing Costs for All Proposed Modules

Source
ARB Certification Fees
Typical current ARB fees per Phase II certification
Typical current ARB fees per Phase I certification
Multiplier for increase in test period (to 6 mos) & test matrix (to 200 cars)
Total number of recertifications
Phase II
Phase I
Est. number of ISD certifications
Total ARB Certification Fees (assume fee for ISD same as for Phase II)
Manufacturers' Certification Fees
Typical current Phase II cost per certification (site preparation, testing)
Typical current Phase I cost per certification (assume 20% of Phase II)
Multiplier for increase in test period (to 6 mos) & test matrix (to 200 cars)
Total number of Phase II recertifications
Est. number of new certifications (i.e., ISD systems or components)
Total number of Phase I recertifications
Total Manufacturers' Phase I, Phase II, & ISD Certification Costs
Total Certification (ARB + Manufacturers) Costs (over 4 years)
Annualized Certification Costs (CRF @ 10% discount rate, 4 yrs)

Notes:
(1) 4 yr annualization period for cost recovery factor (CRF) reflects proposed 4-yr cer
(2) $170,000 typical manuf. certification costs includes $75,000 on-site + $75,000 int
engineering and lab costs to prepare for field certification + $20,000 for pressure r
(3) Typical ARB certification fees taken from most recent ARB invoices for Phase I/II

GDF Population Distribution

National GDF Distribution in 1991	
Gal/mo	Percent of GDFs
3,000	3.80%
8,000	4.80%
17,500	15.00%
37,500	23.50%
75,000	32.30%
150,000	18.20%
300,000	2.40%

PWA (1991 70,661 gal/mo

Source: EPA, 1991
PWA = population-wtd average

Est. California Distribution in 1998	
Gal/mo	Percent of GDFs
3,000	0.76%
8,000	0.96%
17,500	3.00%
37,500	14.10%
75,000	45.65%
150,000	31.30%
300,000	4.22%

PWA (1998) = 99,779 gal/mo

Source: Staff adjustment of EPA, 1991 distribution to fit current average (pop-wtd avg = 99865)

Ref. Source

1 "1999 State of the Industry Report," National Assoc. of Convience Stores, <http://www.cstorecentral.com/register/resource/resource/99soihighlights.html, visited on 01/03/00.

Notes: (a) 1998 average motor fuel sold per store = 95,100 gals/month
(b) Because of 1998's low fuel prices, the average margin cents per gallon dropped to 12.6 cents compared to 1997's 13.4 cents.

2 "EBW Vapor Recovery Equipment Price List," price list spreadsheet from EBW Web site, <http://www.ebw.com/pricelst>, visited on 01/03/00.

Notes: (a) breakaways (avg = $32.50 each)
(b) drop tubes (avg = $111 each, CARB approved)
(c) P/V valves (avg = $65 each, CARB approved)
(d) EPROM + main CPU board (avg = $725 each)
(e) spill containment "bucket" with drain (avg = $482 each)

3 "Model 800 Intelligent ORVR Nozzle," Powerpoint presentation by Healy Systems, <http://www.healysystems.com/NozzlesandHoses/NozzlesandHoses.ppt>, visited on 01/03/00.

Notes: (a) "No excavation of downtime loss with Healy," Slide 14.
(b) "No additional installation costs," Slide 14.
(c) "Retrofit product: approximate installation time takes 2 workers one day per 4 multi-product dispenser station," Slide 14.

4 "Healy ORVR System," <http://www.healysystems.com/orvr1.htm>, visited on 01/13/00.

Notes: (a) "...Healy Model 800 Nozzle converts your vacuum assist dispensers to ORVR with no added below-ground systems and no new electronics."
(b) "...Healy Systems gives you the whole package in the nozzle."